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A Novel Approach For De-Noising CT Images

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***Abstract*—In this modern times and age, digital images play a significant role in our day to-day life. Digital images are utilized in a wide range of fields like medical, business and more .Digital images play a vital part in the medical field in which it has been utilized to analyze the anatomy. These medical images are used in the identification of different diseases. Regrettably, the medical images have noises due to its different sources in which it has been produced. Confiscating such noises from the medical images is extremely crucial because these noises may degrade the quality of the images and also baffle the identification of the disease. Hence, de-noising of medical images is indispensable. In this paper we demonstrate the implementations of de-noising algorithm on CT images. The proposed technique has 4 processing stages. In the first stage the CT brain image is acquired to MATLAB7.5. After acquisition the CT image is given to preprocessing stage. Here the film artifacts are removed. In the third stage, the high frequency components and noise are removed from the CT image using median filter, mean filter and Wiener filter**

***Index Terms*—De-noising, CT image, Filters, Preprocessing, Mean, PSNR.**

I. Introduction

In day to-day applications, Digital images play a significant part. The captured images still endure from several distortions even though the manufacturing technology of the electronic components (such as digital cameras, camera phones, etc) has been enhanced. Noise is one of the most significant among many distortions, and can be introduced by several sources such as: the recording medium (film, digital sensor), transmission medium, and measurement and quantization errors[1]. The intensity of impulse noise has the tendency of being either relatively elevated or low down. Therefore, it could degrade the image quality sternly and cause some loss of image information details. Distortion is one of the most prevalent cases due to additive white Gaussian noise which can be caused by poor image acquisition or by transferring the image data in noisy communication channels. Impulse and speckle noises are comprised in other types of noises .The image acquires a mottled, grainy, textured or snowy appearance with the existence of noise. In literature several filter technique have been proposed for noise reduction in the past[2][3]. Hence, in recent years, in the case of recovering an original image from noisy image, an irresistible interest has been observed. The challenge of removing the noise from images has a sturdy history [4]-[6]. As a corollary, in order to build quantitative post-processing more robust and efficient, image processing procedures often entail removing image artifacts in advance. As a cost-efficient alternate, image processing methods have been exploited through the years to improve the quality of digital images[7]. In general, Image processing, refers to a broad class of algorithms for modification and analysis of an image. During acquisition, post-processing, or rendering/ visualization, Image Processing refers to the initial image manipulation For converting the captured RGB image found from the real source, preprocessing steps are essential so that they can be qualified for performing any binary operations onto it. Image processing alters pictures to progress them (enhancement, restoration), extract information (analysis, recognition), and change their structure (composition, image editing). Image processing is exploited for two different purposes: a) improving the visual appearance of images to a human viewer, and b) preparing images for measurement of the features and structures present. De-noising, Restoration, Pre- Segmentation, Enhancement, Sharpening and Brightness Correction are some of the steps included in image pre-processing.

A. Image De-noising

Noise reduction is an essential step for any complicated algorithms. De-noising is frequently necessary and the initial step to be taken prior to the image data is analyzed. To compensate such data corruption, it is essential to apply an efficient denoising technique. The difficulty of image de-noising is to recuperate an image that is cleaner than its noisy observation. Thus, a significant technology in image analysis is noise reduction and the initial step to be taken prior to images is analyzed. To eliminate the additive noise Image de-noising is used while retaining as much as possible the important signal features. De-noising of images is typically done with the following process: The image is transformed into a domain where the noise component is identified without

Fig.1. Noisy images with Gaussian

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difficulty, to eliminate the noise, a thresholding operation is then applied, and finally to reconstruct a (hopefully) noise-free image, the transformation is inverted[8].The assumption is that noise is captured by the high frequency coefficients, thus by filtering these coefficients , the unwanted noise is removed[9]. The examples of noisy images are shown in Figure.1 and Figure.2

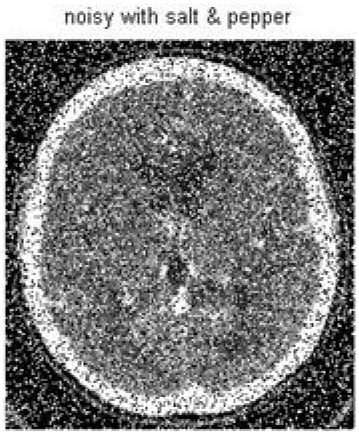
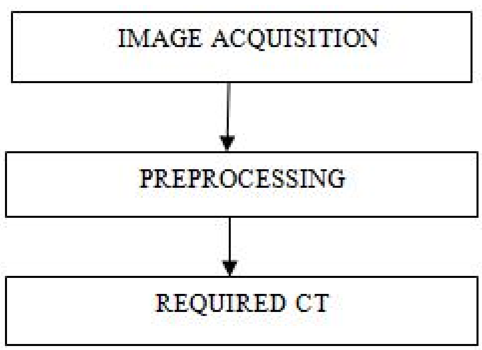


Fig. 2. Noisy images with Salt & Pepper

II. Proposed Method



A. Image Acquisition

CT scanned Images of a patient is displayed as an array of pixels and stored in Mat lab 7.0. The following figure displays a CT brain image in Matlab7.0. A Grey scale image can be specified by a large matrix with numbers between 0 and 255 with 0 corresponding to black and 255 to white. The brain images are stored in the database in JPEG format.(see Figure.3)

Fig. 3. Original Image

B. Preprocessing

This involves operations that are required normally prior to the main data analysis and extraction of information.

III. Proposed Technique

Image Enhancement plays an important role in image processing applications where decisions are to be taken depending on the information available in the image. The decision can be taken depending on the objective quality criteria to find out the goodness of the result. Here in this proposed technique Image enhancement methods are used improve the visual appearance of CT image. The main aim of the enhancement is to remove the high frequency components.

The conventional enhancement techniques such as averaging or low pass filter, median filtering and wiener filtering are used for this work. The enhancement techniques such as wiener filter, low pass filter and median filter are used for removing the Gaussian noise and Salt and pepper noise.

A. De-noising using Averaging Filter

In the Spatial Domain of images, an operation that is similar to convolution is based upon masks. To convolve a mask with an image, first move the mask to every image location. At each movement, multiply the underlying image pixels with the overlying mask pixels, and sum their values. Replace the image pixel at the mask center with this summed value .Figure 4 shows the denoised image from both Gaussian and impulse noise.

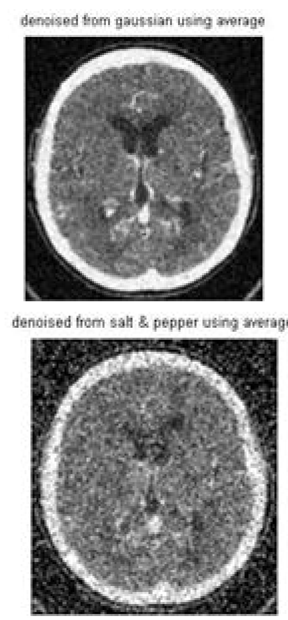


Fig. 4. Shows denoised image using average filter

B. De-noising using Median Filter

The average filter is a linear operator. A very useful non-linear spatial smoothing filter is the median filter. This is more generally known as an order statistics filter, and sometimes as a rank order filter. The procedure for a median filter is as follows:

1. rank (i.e. a list, ordered by increasing value) the image pixels that lie under the mask.
2.Then the value of the center pixel is replaced by the median of the grey levels in the neighbourhood of that pixel or the pth percentile value (in the case of a general order-statistics filter).

The median filter is effective in removing salt-and-pepper noise, which are Spurious values. This is seen the Figure 5 given below

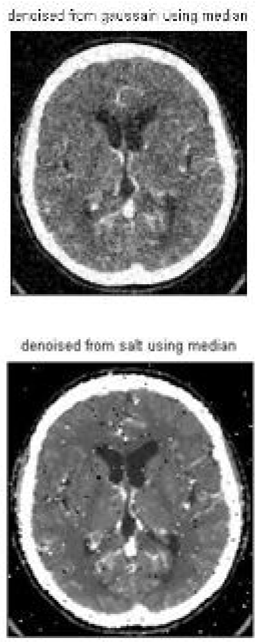
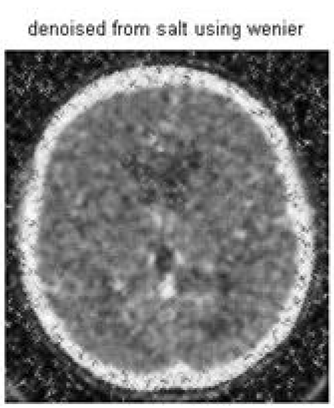


Fig. 5. Shows denoised image using median filter

C. De-noising using Wiener Filter

It should be noted that the image restoration tools described here work in a similar manner for cases with blur due to incorrect focus. In this case the only difference is in the selection of H.In the real world, however, there are two problems with this method. First, H is not known precisely. Engineers can guess at the blurring function for a given circumstance, but determination of a good blurring function requires lots of trial and error. Second, inverse filtering fails in some circumstances because the sine function goes to 0 at



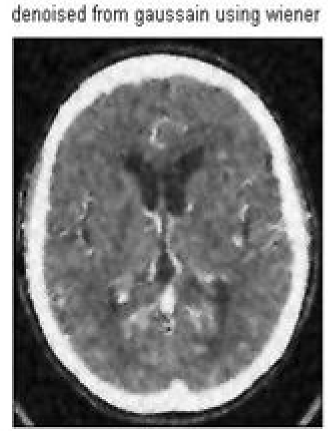


Fig. 6. Shows denoised image using wiener filter

some values of x and y. Real pictures contain noise which becomes amplified to the point of destroying all attempts at reconstruction of a Fest. The best method to solve the second problem is to use Wiener filtering[10]. This tool solves an estimate for F according to the following equation:

Fest(u,v)=|H(u,v)|^2.G(u,v)/(|H(u,v)|^2.H(u,v)+ K(u,v))

K is a constant chosen to optimize the estimate. This equation is derived from a least squares method..The figure 6 given shows the denoised image from both Gaussian and salt & pepper noise.

IV. Performance Evaluation

It is very difficult to measure the improvement of the enhancement. If the enhanced images prove good to the observer so as to perceive the region of interest better, then we say that the original image has been improved. The parameter such as the mean and PNSR helps to measure the local contrast enhancement.The table I and II shows the mean values and the PSNR values calculated using the above 3 filters.

Table I. Comparison Of Mean Of Original With Noisy And Denoised Images

Original Image		97.8087
Image with	Salt & pepper noise	106.9451
	Gaussian noise	100.1439
De-noised image with		
Average filter		98.3619
Gaussian noise	Wiener filter	99.9249
	Median filter	98.5714
Salt& Pepper noise	Wiener filter	97.9106
	Median filter	97.9106

Table II. Performance Analysis Of Filters

a)On Salt & Pepper Noise

Filter	PSNR
average	10.97
median	26.21
Wiener	21.11

b)Performance Analysis Of Filters On Gaussian Noise

Filter	PSNR
average	10.97
median	27.94
Wiener	27.41

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Conclusions

This work describes the implementation, testing and the performance evaluation of the 3 de-noising algorithms for de-noising the CT brain images. CT images are acquired and the noise are removed using the average filter, median filter and the Wiener filter.It could be concluded from the above results the best filter for removing salt and pepper noise is median filter and on Gaussian noise both median and Weiner filter are good.

References

[1] Lakhwinder Kaur, Savita Gupta and Chauhan, "Image De-noising using Wavelet Thresholding", Indian Conference on Computer Vision, Graphics and Image Processing, 2002

[2] Carl Steven Rapp, "Image Processing and Image Enhancement", Frontiers in Physiology, 1996

[3] Kulk arni, Meher and Nair, "An Algorithm for Image De-noising Robust Estimator", European Journal of Scientific Research, Vol.39, pp.372-380, 2010

[4] Syed Amjad Ali, Srinivasan Vathsal and Lal kishore, "CT Image De-noising Technique using GA aided Window-based Multi wavelet Transformation and Thresholding with the Incorporation of an Effective Quality Enhancement Method", International Journal of Digital Content Technology and its Applications, Vol.4, No. 4, 2010

[5] Pierrick Coupé ,Pierre Yger, Sylvain Prima, Pierre Hellier,Charles Kervrann , Christian Barillot, "An optimized block wise nonlocal means de-noising filter for 3-D magnetic resonance images", Vol.27, No.4, pp.425-441, 2008

[6] Radu Ciprian Bilcu and Markku Vehvilainen, "A Novel decomposition scheme for image de-noising", IEEE International Conference on Acoustics, Speech and Signal Processing, pp.577-580, 2007

[7] Hiroyuki Takeda, Sina Farsiu and Peyman Milanfar, "Kernel Regression for Image Processing and Reconstruction", IEEE Transactions on Image Processing, VOL. 16, NO. 2, Feb 2007

[8] Peter Kovesi, "Phase Preserving Denoising of Images", 2007

[9] Jaya, Thanushkodi and Karnan, "Tracking Algorithm for De-Noising of MR Brain Images", International Journal of Computer Science and Network Security, Vol.9, No.11, pp.262-267, 2009

[10] Gonzalez, R.C., Woods, R.E., Book on "Digital Image Processing", 2nd Ed, Prentice-Hall of India Pvt. Ltd.,2002

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